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Complementarities of HRM Practices
A Case for Employing Multiple Methods and Integrating Multiple Fields

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A Case for Employing Multiple Methods and Integrating Multiple Fields*

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We provide an overview over different literature streams that aim at explaining the origin of persistent productivity differences across organizations by variation in the use of management practices. We focus on human resource management (HRM) practices, document gaps in the literature, and show how insights from behavioral economics can inform the analysis. To this end, we develop a simple agency model illustrating how social preferences influence the design and impact of incentive schemes, investigate how auxiliary HRM practices can strengthen this interaction, and provide an overview over empirical investigations of this questions. Finally, we identify avenues for further research in this field.

Keywords: Complementarities; HRM practices; Method mix; Social preferences; Persistent Productivity Differences.

JEL Classification Numbers: D22, M50, M52.

1. Motivation

One of the most important developments in the study of firms in economics and management has been the increasing availability of firm-level micro-data and the ensuing emphasis on firm heterogeneity. Newly available large and detailed data sets have provided strong evidence for enormous and persistent heterogeneity of firms (and workers) over a range of dimensions, even in narrowly defined industries. These observations are starkly at odds with theoretical predictions and are commonly referred to as "persistent productivity differences" (PPDs) across firms (cf. Syverson, 2011). Theory predicts that competitive forces will induce firms to quickly adopt innovations, only leaving room for short-term heterogeneity, but not for the persistent patterns that emerge in the data. Indeed, PPDs are evident even in seemingly uniform industries without room for differentiation, with high competition and with minor frictions: for instance, in his study using data on the U.S. concrete industry, Syverson (2004a) finds a standard deviation of almost 0.4 in total factor productivity (TFP) in his sample. Taking a closer look at the empirical patterns, it is evident that the magnitude of PPDs is overwhelming. Syverson (2004b) reports that on average, even within four-digit SIC industries in the U.S. manufacturing sector, a firm at the 10th percentile of the productivity distribution generates only half of the output that a firm at the 90th percentile is able to generate with the same input. While this seems like an impressing difference already, these PPDs are even larger for some industries or countries, like India and China, where the average TFP differentials between the 10th and 90th percentile are larger than 1:5 (Hsieh and Klenow, 2009), even when controlling for input qualities (Lane et al., 1999). The question that naturally arises from this surprising evidence is straightforward – how can these persistent productivity differences be explained?

In fact, researchers have come up with several explanations that include, for instance, differences in input quality (e.g., Abowd et al., 2005), learning-by-doing (e.g., Benkard, 2000), or differences in management practices (e.g., Bloom et al., 2014); however, even when controlling for these facts, there still remains substantial variation (see Syverson, 2011).

Especially in the measurement and documentation of management practices across firms, where the scope for explaining PPDs seems to be large, much progress has been made recently.[1] We add to this important stream of literature and highlight two prominent approaches to discuss the role of management practices and organizational design choices. Although, as already mentioned above, a plethora of theoretical as well as empirical accounts for the underlying problem have been proposed, we argue that the question has not been answered in an exhaustive way. Trying to make sense of PPDs

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[1]Also among practitioners, there has been a recent focus on this in the form of an evidence-based management movement, as indicated by Pfeffer and Sutton (2006).

by applying fundamentally different approaches reminded us of the famous poem by John Godrey Saxe retelling the old Asian legend about the blind men and the elephant: scholars with different foci describe a common problem, but without joint effort they suffer from a limited perspective and may fail to see the whole elephant. Thus, we try to overcome this problem by joining different streams of literature to show that there is a common ground to start from. Our explicit goal is to pave the way for future research avenues and invite other scholars to join our endeavor of drawing a comprehensive picture of the elephant called PPDs.

While the World Management Survey (WMS) on the one hand as well as "insider econometrics" studies (cf. Ichniowski and Shaw, 2003) on the other hand have been concerned with the impact of management practices of organizational performance, their focus is quite different. While the former concentrated on measuring (aspects of) management quality, showing cross-sectional correlations with productivity (Bloom and Van Reenen, 2007) the latter focused on investigating within-firm data suggesting that human resources components of management (HRM) can affect productivity in a complementary fashion (Ichniowski et al., 1997). It is important to note that the underlying model of measurement as well as the theoretical rationale differs to some extent: whereas the WMS assumes additive index building with different practices causing a higher order factor termed management quality, insider econometrics claim that those practices interact, i.e. exhibit complementary effects if combined in the right way.[2] We argue that albeit WMS has been an influential and important step, from our perspective it is highly unlikely that those practices act virtually independent from one another as assumed by additive indexing.

While the potential of management and HRM practices to resolve part of the PPD puzzle has been carefully documented, we argue that another stream of research, namely behavioral economics, also has the potential to contribute interesting and potentially important aspects, in particular by shedding light on how complementarities between HRM practices could precisely evolve. From our perspective, the recent discussions concerning individual heterogeneity also play an important role for how complementarities between practices come to life by interacting with heterogeneous agents. For instance, social preferences have been shown to be an important driver of behavior and, consequently, have the potential to serve as a motivator, as recent work in the field of behavioral contract theory shows (e.g., Fehr and Schmidt, 2006; Englmaier and Leider, 2012a). But as those preferences differ across agents this also has implications for the use of HRM practices: a principal with a strong mission focus trying to substitute monetary incentives with a mission statement should make sure that he recruits agents who also have a strong mission focus (Cassar, 2014a). A more detailed assessment utilizing a simple theoretical model and an overview of empirical evidence is provided in Section

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[2]A more detailed description of these literature streams is provided in Sections 2.1 and 2.2.

3.

For answering the more general question how the potential explanatory power of HRM practices can best be studied, we suggest combining different methods and angles. Within this general agenda, WMS-style cross-sectional studies are important as they map correlations and identify effective clusters of practices; to do so, in the light of the above suggested role for behavioral insights, the scope of these cross-sectional studies has to be broadened to capture a wide set of practices employing a measurement model to assess potential complementarities (see Section 4). In parallel, insider-econometric style studies help to provide in-depth insight into what matters in specific firms. In addition to these approaches, we argue that, in a first step, it is important to develop solid theoretical models yielding testable predictions, in particular including behavioral constructs. In a second step, these predictions are are tested using both laboratory and field experiments to establish causality for theoretically suggested mechanisms.

The rest of the paper proceeds as follows: in Section 2, we provide a somewhat selective review of the existing literature. In Section 3, we then demonstrate what behavioral economics has to contribute by developing a simple model introducing agents with social preferences to the standard principal-agent framework, relating our insights to empirical findings, and posing new questions. Building on these, in Section 4, we describe what we identify as an empirical agenda before concluding in Section 5.

2. Review of the Literature

This section comprises of a brief overview of the literature on management and HRM practices and their role in explaining productivity. More precisely, as indicated above, we focus on the World Management Survey and insider econometric studies.[3]

2.1. World Management Survey

Over the last decade, the World Management Survey (WMS), a survey run by a team of researchers around Nicholas Bloom and John Van Reenen, led to numerous important insights to explain PPDs across firms. In particular, the WMS explores how "good" management practices can explain firm heterogeneity and focuses on monitoring, targets, and incentives, to explore the impact of management practices on firm produc-

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[3]It is important to note that this article is not meant to be an exhaustive overview on the extensive literature on the World Management Survey, insider econometric studies, or on complementarities of HRM practices. Rather we provide a brief summary of these literatures to act as a background for developing our main argument – that behavioral economics insights can contribute to the study of complementarities of HRM practices – and based on that sketch a research agenda. Almost necessarily, in doing so we paint a subjective picture and brazenly over-represent own work throughout the paper. For excellent reviews see, e.g., Ichniowski and Shaw (2013) or Bloom et al. (2014).

tivity in different sectors and countries; for an overview, see Bloom et al. (2014).[4] In closely related work, these authors have documented complementarities between (what they argue constitute) "good" management practices and more general firm investment behavior, namely in IT, see Bloom et al. (2012). They document that good management in the above sense makes IT investments more profitable and show that a significant share of the productivity advantage of US firms over European firms can be explained by IT usage and together with "better" management.

Although some of the heterogeneity across firms can be explained by the insights provided by WMS data, a lot of unexplained variance is left. This drawback is illustrated in Figure 1, which is based on the data used in Bloom and Van Reenen (2007), and plots the residuals of a regression of the log number of sales on the log number of employees, one of the performance measures used by Bloom and Van Reenen (2007), against the average z-standardized management scores of the surveyed firms. As the observations scatter widely around the regression line, the average management score still seems to be a noisy measure, even when controlling for firm size. Hence, to generalize from this picture, a lot of unexplained variation is left to be explained.

-- Include Figure 1 about here. --

Concerning HRM practices, an important drawback is that the WMS essentially focuses on one type of HRM practices, those related to incentives. Hence, even if the WMS data are helpful in explaining some (or even much) of the variation in productivity, substantial amounts of PPDs remain unexplained. A particular aspect of HRM practices, that is not at the center of the WMS but that might matter a lot, is their complementarity. The study of these complementarities has been at the center of insider econometrics studies, covered in the next section.

2.2. Insider Econometrics

Insider econometrics studies aim at studying the performance contribution of HRM more closely. In particular they broaden the sole focus on incentive pay and allow to take other HRM practices into account (Ichniowski and Shaw, 2003). This within-firm work has suggested that the specific combination of complementary HRM practices may affect productivity. Aimed at producing empirical estimates of the value of alternative human resource management practices, numerous studies in this field indicate that various innovative practices are complements, i.e. "using one more intensely

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[4]While the WMS proper is a compilation of a large number of semi-structured telephone interviews, starting out as cross-sectional but recently also building up a panel component, the correlational evidence from the WMS is recently corroborated by smaller Randomized Control Trials (RCTs); see, e.g., Bloom et al. (2013).

increases the marginal benefit of using others more intensely" (Holmström and Milgrom, 1994, p.973). The defining characteristic of a wide range of studies that are summarized as belonging to the insider econometrics literature – see, for example, Ichniowski et al. (1997); Lazear (2000); Hamilton et al. (2003); Shearer (2004); Bandiera et al. (2007, 2009) – is that they use highly detailed, production-line specific data to tie non-standard HRM practices like pay-for-performance schemes, work teams, cross-training, and routinized labor-management communication to productivity growth. In sum, these insider econometrics studies show that factors other than incentive pay, like composition of work teams or training, also matter for productivity of firms.[5]

To draw a broad conclusion, the research on the effect of management practices on firm productivity outlined above indicates that HRM practices and complementarities among them matter.

3. What can Behavioral Economics Research Contribute?

After having briefly summarized some evidence in the previous section, we want to develop our argument that recent insights from behavioral economics research allow us to gain additional insights by highlighting an additional dimension of complementarities: employees' personality traits interact in non-trivial ways with the design of incentive schemes and the choice of HRM practices more generally. This indicates a case for jointly analyzing selection and recruiting and the organizational choices of firms.

Both lines of literature, the vast survey-type data of the WMS as well as the rich firm-level data studies utilizing an insider econometrics approach, do not include how recruiting and as a consequence the matching of types might interact with HRM practices. This omission is reasonable from a neoclassical viewpoint as these factors can be separated from optimal incentive design. To illustrate this line of reasoning, think of worker heterogeneity: if we assume that ability is the standard dimension of heterogeneity, it is evident that every firm wants, ceteris paribus, to hire the most able workers. Given these workers, the agency problem is solved. Adding heterogeneity in risk-attitudes, however, leads to a somewhat more advanced problem, as the optimal intensity of incentives is now affected by the risk attitudes of the given employee pool (cf. Bandiera et al., 2015). In both of these cases, ability and risk attitude heterogeneity lead to differences in incentive heterogeneity, but do not affect the structure and nature

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[5]In a similar vein but largely independent from one another, scholars of strategic human resource management (SHRM) have been investigating the impact of HRM on organizational-level outcomes in general for more than 20 years (Huselid, 1995; Becker and Gerhart, 1996; Becker and Huselid, 2006). As a result, increasingly sophisticated theoretical formulations have been proposed (e.g., Delery, 1998; Gerhart, 2007; Jiang et al., 2012) and a plethora of empirical evidence has been presented (see Combs et al., 2006, for a review).

of organizational choices in a broader sense. Thus, recruiting of workers and incentive or organizational design can be (and have been) treated separately.

However, in contrast to that, much research has been conducted in behavioral economics in the course of the last two decades that indicates that this clean separation of effects might not be a correct representation of reality, but that it might as well be the case that recruiting and matching of types interact with other HRM practices like incentive schemes. E.g., Delfgaauw and Dur (2007) show how incentive schemes can help to attract motivated workers in a setting with heterogeneously motivated workers, and Jones et al. (2014) point out that employer signaling might be the cause for selection and sorting effects of employees in firms; more evidence pointing to that conclusion relating to social preferences is discussed in Section 3.2.

Based on these insights, our goal in the subsequent sections of this paper is to highlight how complementary effects of HRM practices and interactions with worker characteristics matter and how these can be studied. In our view, this requires the use of multiple research methods. To this end, we focus on social preferences within an organizational context, and show how these preferences influence the optimal use of HRM practices.[6] Of course, we are aware of the fact that this is only a small piece of what behavioral economics research has to offer and that there are numerous other areas to be included in the study of organizations – we provide a brief discussion of other particularly fruitful topics in Section 5.

In the following sections, we develop a simple, illustrative model introducing reciprocal preferences into the principal-agent framework based on Englmaier and Leider (2012a). In Section 3.1.1, we solve for the optimal contract before adding limited liability constraints (Innes, 1990) and comparing selfish and reciprocal agents in Section 3.1.2. We derive predictions on the optimal incentive intensity dependent on reciprocity, which we then relate to HRM practices (non-monetary transfers, delegation) in Section 3.1.3. Section 3.1.5 highlights broader interpretations of our model framework.

3.1. An Illustrative Model

We consider a simple binary principal-agent framework where both the principal and the agent are risk-neutral. There are two states of the world that are characterized by two possible outcomes, q_1 and q_2, with $q_1 < q_2$ and $q_i > 0$ $\forall i \in \{1, 2\}$. The agent can choose between two actions, a_L and a_H, with related costs $c(a_L) < c(a_H)$. The probabilities of the principal's outcomes are conditional on the action taken by the agent: $Pr(q_2|a_j) = \pi_j$ $\forall j \in \{L, H\}$, where $\pi_H > \pi_L$, which implies that the higher outcome is a better signal for high effort. Hence, the principal's expected return is

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[6]Together with other kinds of non-standard preferences like time and risk preferences, social preferences have been researched most intensely in the field of behavioral economics (DellaVigna, 2009).

given by $ER(a_j) = (1 - \pi_j)q_1 + \pi_j q_2 \;\; \forall j \in \{L, H\}$.

We assume that effort is not contractible; hence, wages can only be paid conditional on outcomes. Thus, the principal offers the following contract to the agent: $(w, b, \hat{a})$, where w denotes a secure wage payment (a salary) for the agent in every state of the world, b an additional bonus that is paid in case that outcome q_2 is realized and $\hat{a}$ represents a non-binding request for an action.[7] This request reflects the performance level expected by the firm that is known to the worker (e.g., through job descriptions or a code of conduct) and serves to fix the agent's beliefs about the principal's intended generosity; see the discussion below and in Englmaier and Leider (2012a).

The agent has an inherent concern for reciprocity η with $\eta \in [0, +\infty)$, where we assume to focus the analysis here that this type η is publicly observable. His utility from taking action a_j when $\hat{a}$ is requested is given by

$$
\begin{aligned}
U(a_j, \hat{a}) = \; & (1 - \pi_j)w + \pi_j(w + b) - c(a_j) \\
& + \; \eta \left[(1 - \hat{\pi})\,w + \hat{\pi}(w + b) - c(\hat{a}) - \bar{u} \right] ER(a_j).
\end{aligned}
$$

As is evident from the utility function, a reciprocal agent ($\eta > 0$) does not only derive utility from the wage payment as is common in agency models (first part of utility function), but also from internalizing the principal's welfare (third part). This part of the function represents the case that reciprocal utility is "triggered" when the proposed wage scheme provides the agent with a rent in excess of his outside option $\bar{u}$. In the simple case of our model, $\bar{u}$ is assumed to be fixed exogenously.

For simplification, we also assume that $\bar{u} = 0$, $c(a_L) = 0$, and define $c(a_H) = c$.

3.1.1. Benchmark Case

Trivially, when assuming that effort is contractible, the first best solution is implemented by any wage scheme compensating the agent for his effort costs c. Furthermore, without further restrictions, it can easily be shown that the principal can induce a risk-neutral agent to exert high effort for first-best costs, even when effort is not contractible.

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[7]When developing the model in the following subsections, we always discuss optimal wages, as is common in agency models. As the model is formulated in utility terms, however, note that these are to be interpreted broadly and might include multiple ways of transferring utility to employees. A discussion of this is provided in Section 3.1.5.

The principal faces the following optimization problem when implementing a_H:

$$\max_{w,b,\hat{a}} \quad (1 - \pi_H)(q_1 - w) + \pi_H(q_2 - w - b)$$

$$s.t. \quad (1 - \pi_H)w + \pi_H(w + b) - c + \eta\left[(1 - \hat{\pi})w + \hat{\pi}(w + b) - c(\hat{a})\right]ER(a_H) \geq 0, \tag{IR}$$

$$(1 - \pi_H)w + \pi_H(w + b) - c + \eta\left[(1 - \hat{\pi})w + \hat{\pi}(w + b) - c(\hat{a})\right]ER(a_H) \tag{IC}$$
$$\geq (1 - \pi_L)w + \pi_L(w + b) + \eta\left[(1 - \hat{\pi})w + \hat{\pi}(w + b) - c(\hat{a})\right]ER(a_L),$$

$$\text{and} \quad \hat{a} = a_H. \tag{EB}$$

The first and second constraint represent the standard individual rationality (IR) and incentive compatibility (IC) restrictions, respectively. The third constraint represents the restriction that beliefs have to be in equilibrium (EB). More precisely, this means that the agent can reasonably expect the kindness of the proposed contract offer as his expected rent when choosing action $\hat{a}$. Thus, destructive and "babbling" equilibria are ruled out. However, note that it is sufficient to assume (EB) and solve to implement $\hat{a} = a_H$ (cf. the discussion in Englmaier and Leider, 2012a).

For deriving the optimal contract, it is helpful to first think about the properties of the constraints at the optimum. Considering (IR), it is straightforward to see that this constraint has to be binding: suppose (IR) was slack.[8] Then, the principal could decrease w by the amount $\epsilon > 0$. If ϵ is small enough, the principal still manages to fulfill (IR) and at the same time increases her expected outcome without violating the (IC), because the (IC) depends on the bonus b (and thus on the wage spread between the states) which does not change. Thus, (IR) cannot be optimally slack.

Since (IR) is binding, the agent does not receive a rent, i.e., the reciprocal part of his utility is equal to zero and hence drops out of the problem. Thus, the optimal contract can easily be derived by solving the constraints of the standard problem for w and b.

Now, consider the (IC). It can easily be seen that since the agent is risk-neutral and does not care about the wage spread, there exist an infinite number of optimal contracts implementing a_H at first-best cost for the principal as long as $b \geq c/\Delta\pi$, where $\Delta\pi = \pi_H - \pi_L$. For reasons of simplicity and to make the first and second best solutions comparable, we focus on the case that the wages are set to solve (IC) with equality. Then, the properties of the optimal contract are summarized in the following proposition.

Proposition 3.1. *Under hidden action, the risk-neutral principal proposes the following*

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[8]Note, when we below add limited liability as a source of inefficiency into the model, (IR) may be optimally slack, as in Englmaier and Leider (2012a).

contract to the risk-neutral agent:

$$w = -\frac{\pi_L}{\Delta\pi}c < 0, \qquad b = \frac{c}{\Delta\pi} \qquad \textit{and} \qquad \hat{a} = a_H.$$

In doing so, she can induce the agent to exert a_H at first-best implementation cost $B^{FB}(a_H) = c$, leaving the agent with no rent. This holds for every $\eta \in [0, +\infty)$.

The optimal contract punishes the agent if the low outcome is realized and rewards him if the good outcome is realized. The intuitive explanation for this result is straightforward: since effort is not contractible, the principal has to align the agent's interests to hers. Recall that the agent is risk-neutral; thus, the principal can just structure incentives steeply and transfer risk to the agent without having to compensate him for that. Note that just as in Englmaier and Leider (2012a), reciprocity does not have an effect on the optimal contract in the first best; the "standard contract" prevails.

3.1.2. Limited Liability

Now, consider the case that the agent is wealth constrained and thus has to receive a minimal wage in every state of the world that cannot be negative; more formally, consider $w \geq \underline{w} \geq 0$. With an additional limited liability constraint like this, the principal then faces a trade-off between rent extraction and incentive provision when designing the optimal contract.

Now, the optimization problem of the principal implementing a_H (when again assuming (EB) and solving to implement $\hat{a} = a_H$) takes the following form:

$$\max_{w,b} \quad (1 - \pi_H)(q_1 - w) + \pi_H(q_2 - w - b)$$

$$s.t. \quad (1 - \pi_H)w + \pi_H(w + b) - c + \eta\left[(1 - \pi_H)w + \pi_H(w + b) - c\right]ER(a_H) \geq 0,$$
$$\text{(IR)}$$

$$(1 - \pi_H)w + \pi_H(w + b) - c + \eta\left[(1 - \pi_H)w + \pi_H(w + b) - c\right]ER(a_H) \qquad \text{(IC)}$$
$$\geq (1 - \pi_L)w + \pi_L(w + b) + \eta\left[(1 - \pi_H)w + \pi_H(w + b) - c\right]ER(a_L),$$

$$\text{and} \quad w \geq \underline{w}. \qquad \text{(LL)}$$

It is immediately clear that the principal is not able to implement the first best contract in this case because she would have to set $w < 0$, which would violate the limited liability constraint (LL). Thus, we have to derive the second best contracts, which we do by considering two cases – selfish and reciprocal agents.

Selfish agent. First, consider the optimal contract for a selfish agent ($\eta = 0$). Then, the optimization problem boils down to the standard case. Again considering the properties

of the constraints in the optimum, it is easy to see that (LL) binds at the optimum. Additionally, (IC) is binding, which provides us with two equalities to solve for the optimal contract. The properties of this contract are summarized in the following proposition.

Proposition 3.2. *Under hidden action with limited liability ($w \geq \underline{w} \geq 0$), the risk-neutral principal proposes the following contract to the risk-neutral, selfish agent ($\eta = 0$):*

$$w = \underline{w}, \qquad b = \frac{c}{\Delta \pi} \quad and \quad \hat{a} = a_H.$$

In doing so, she can induce the agent to exert a_H, but only at implementation cost

$$B^{SB}(a_H) = c + \underline{w} + \frac{\pi_L}{\Delta \pi}c.$$

The agent receives a limited liability rent:

$$U(a_H) = \underline{w} + \frac{\pi_L}{\Delta \pi}c.$$

In this case, the first-best solution can no longer be employed. The (LL) constraint limits the range of possible wage payments. Comparing the boni in the first and second best cases reveals that they do not differ ($b = c/\Delta\pi$ in both cases), which makes sense when considering that the (IC) is binding in both cases and thus the wage spread cannot be reduced further; however, the principal cannot charge negative wages, thus she has to increase the base wage w and consequently pay a rent to the agent. In other words, while the principal is able to use both carrot and stick in the first best case, she loses the opportunity of using the stick with limited liability and has to rely on the "carrot" only to incentivize the agent.

Reciprocal agent. Now, consider a reciprocal agent with $\eta > 0$. We first illustrate this situation by a verbal argument: since the agent is not only motivated by monetary incentives, but also by the reciprocal part of his utility that is triggered when he receives a rent exceeding his outside option, the principal has an additional instrument to induce a_H. Stated differently, the limited liability rent has an additional incentive component and helps the principal to align the agent's interests to some degree with her own.

Indeed, solving the optimization problem in the same fashion as the standard limited liability problem yields the same base wage w, but the bonus payment b, and thus also the wage differential between the states of the world, are reduced.[9] The properties of the solution are summarized in the following proposition.

Proposition 3.3. *Under hidden action with limited liability ($w \geq \underline{w} \geq 0$), the risk-neutral*

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[9]Note that the bonus is decreasing in η. Assuming $c \geq \underline{w}$ is sufficient to ensure a positive b.

principal proposes the following contract to the risk-neutral, reciprocal agent ($\eta > 0$):

$$w_1 = \underline{w}, \qquad b = \frac{c}{\Delta\pi} - \frac{\eta\Delta ER}{\Delta\pi + \eta\Delta ER\pi_H}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right) \qquad and \qquad \hat{a} = a_H.$$

In doing so, she can induce the agent to exert a_H, but only at implementation cost

$$B_\eta^{SB}(a_H) = c + \frac{\Delta\pi}{\Delta\pi + \eta\Delta ER\pi_H}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right).$$

The agent's utility is then

$$U(a_H) = (1 + \eta ER_H)\left[\frac{\Delta\pi}{\Delta\pi + \eta\Delta ER\pi_H}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right)\right].$$

Comparing the optimal contract for selfish and reciprocal agents reveals that $B_\eta^{SB}(a_H) < B^{SB}(a_H)$; i.e., the principal can implement a_H at lower cost with a reciprocal agent. This corresponds to the verbal explanation given above: in both cases, the principal has to pay a rent due to wealth constraints of the agent; however, while this rent is "lost" on a selfish agent, it serves as an additional incentive for a reciprocal agent. This is also reflected in the bonus payment b, which is lower for reciprocal agents as the (non-zero term comprising of the) limited liability rent, weighted by a term reflecting reciprocity η and effectiveness of reciprocal behavior ΔER, can be subtracted. The intuition for the smaller expected wage bill in this case is straightforward: the wage differential for the reciprocal agent can be smaller because the positive rent provides an additional motivation to the reciprocal agent. More formally, $b_{\eta>0} < b_{\eta=0}$.

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                -- Include Figure 2 about here.   --
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The three cases of the exemplary first best contract, the second best contract for a selfish agent and the second best contract for a reciprocal agent in comparison are illustrated in Figure 2.

Comparative statics. To see what happens to the wage differential if the principal is faced with a more reciprocal agent, we take the derivative of the optimal b with respect to η:

$$\frac{\partial b}{\partial \eta} = -\frac{\Delta\pi\Delta ER}{(\Delta\pi + \eta\Delta ER\pi_H)^2}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right) < 0.$$

Hence, the principal can offer a lower b to a more reciprocal agent, which is a rather intuitive result.[10] Subsequently the expected wage bill for employing the agent also

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[10]Also, since the increase in the principal's expected revenue due to choosing a_H rather than a_L, ΔER, is always multiplied with η in b, the same holds true if the value of effort increases for the principal.

decreases in η.[11] This is summarized in the following proposition.

Proposition 3.4. *b is decreasing in η and ΔER. As a consequence, the expected wage bill $B_\eta^{SB}(a_H)$ is also decreasing in these factors.*

Summary of the findings.   To sum up, by introducing limited liability to a basic model of hidden action in a principal-agent framework allowing for reciprocity concerns of the agent, we can show that the principal is able to reduce the incentive intensity when facing a more reciprocal agent.

3.1.3. HRM Practices in the Model Framework

In their seminal textbook, Milgrom and Roberts state that "[...] important features of many organizations can be best understood in terms of deliberate attempts to change the preferences of individual participants [...]. As a result, organizationally desired behavior becomes more likely." They continue to argue that this "is clearly an element of leadership [...] and it has much to do with practices of organizing semipermanent groups of workers and encouraging them to interact socially as well as at work." (Milgrom and Roberts, 1992, , p.42)

While Milgrom and Roberts then continue down the neo-classical route, positing a selfish, rational actor framework, with the progresses made by behavioral economic research we can begin to more carefully study the content of their statement. Certain HRM practices, like some intense forms of team work, may affect preferences, in particular, strengthen pre-existing social preferences.

When conceptualizing how one could incorporate HRM practices in the relatively general model framework outlined above, one can think of several different ways to do so, each with different theoretical and empirical implications. Here, we focus on ways of influencing the employee's reciprocal motivation, η, by HRM practices like team building, empowerment, or delegation of decision rights.[12] As a consequence, we have to think of η as consisting of two parts – the agent's inherent concern for reciprocity, η_1, as well as a second part that can be influenced by HRM, η_2. Depending on how these two factors interact, different predictions can be derived from the model.

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[11]Considering the limit case $\eta \to \infty$, we can show that for an infinitely reciprocal agent, the principal could even induce high effort a_H for first best cost:

$$\lim_{\eta \to \infty} B_\eta^{SB}(a_H) = \lim_{\eta \to \infty} \left[c + \frac{\Delta\pi}{\Delta\pi + \eta\Delta ER\pi_H} \left(\underline{w} + \frac{\pi_L}{\Delta\pi} c \right) \right] = c$$

which equals $B^{FB}(a_H)$.

[12]In a similar vein, Pfeffer (2007) stresses that there are certain types of high-commitment HRM practices that serve to activate reciprocal motivation. These include investments in training, information sharing, or decentralized decision making as signals of trust.

To fix ideas, consider a multiplicative model: $\eta = \eta_1 \times \eta_2$.[13] For simplification, we assume that the agents' preference types are known. We exchange η in Proposition 3.3 and derive comparative statics by taking the derivative of the optimal bonus payment:

$$\frac{\partial b}{\partial \eta_2} = -\frac{\eta_1 \Delta \pi \Delta ER}{(\Delta \pi + \eta_1 \eta_2 \Delta ER \pi_H)^2} \left(\underline{w} + \frac{\pi_L}{\Delta \pi} c \right) < 0.$$

Here, the interplay of the two reciprocal factors is complex, which can be seen when considering the second and cross-derivative:

$$\frac{\partial^2 b}{\partial \eta_2^2} = \frac{2\eta_1^2 \Delta \pi \left(\Delta ER \right)^2 \pi_H}{(\Delta \pi + \eta_1 \eta_2 \Delta ER \pi_H)^3} \left(\underline{w} + \frac{\pi_L}{\Delta \pi} c \right) > 0,$$

$$\frac{\partial^2 b}{\partial \eta_1 \eta_2} = -\frac{\Delta \pi \Delta ER \left(\Delta \pi - \eta_1 \eta_2 \Delta ER \pi_H \right)}{(\Delta \pi + \eta_1 \eta_2 \Delta ER \pi_H)^3} \left(\underline{w} + \frac{\pi_L}{\Delta \pi} c \right) \lesseqgtr 0.$$

While the former is globally positive, the latter is only positive for a threshold value of $\eta_1 \eta_2 > \Delta \pi / \Delta ER \pi_H$, i.e., for a sufficient amount of reciprocal motivation already present. This hints at a separation of cases – below the threshold, investments in η will hardly reduce the bonus payment necessary and are thus not profitable for the firm, while investment for levels above the threshold pay off. To illustrate this relationship, consider the situation that the firm has the opportunity to implement a training program that is known to increase η_2 from 1 to 1.5, but that has implementation costs of $ 1,000. Note that the investment decision cannot be made without considering the level of η_1: when it is small, the optimal bonus payment will only decrease by a small amount that does not exceed $ 1,000. For a large enough η_1, however, the increase of η_2 by 0.5 will result in a bonus decrease that exceeds $ 1,000 – in the former case, the firm optimally does not invest, while in the latter case, it does, although the effectiveness of the training itself has not changed. In this way, a higher level of η_1 increases marginal returns from investing in η_2, which reflects the complementarity definition given above. This relationship is also depicted graphically in Figure 3.

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It is evident that the firm can foster reciprocal reactions of their employees by investing into practices that increase η_2 as long as the employee has an inherent concern for reciprocity at all ($\eta_1 > 0$). Again, it is important to note that the strength of this influence and hence the decrease of the necessary bonus payment depend on the level of the agent's inherent concern for reciprocity. In other words, η_1 and η_2 are complements and thus interdependent.

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[13] See Appendix A for an additive modelling, $\eta = \eta_1 + \eta_2$, and the discussion of its implications.

Implications. Modelling employees' preferences and preference enhancing HRM policies as complements makes thinking about these investments more complicated. When the ex ante level of overall reciprocal motivation is low, either because the workforce selected has a low concern for reciprocity or because there are no other investments in the form of HRM practices, additional investment does not lead to significant gains in terms of lower bonus payments for the firm and is hence hardly profitable. In contrast, when ex ante reciprocal motivation is already above a certain threshold, gains from increasing investment in either dimension are larger. Phrased differently, as η_1 is related to hiring practices used in personnel selection, these practices are complementary to practices that directly increase η_2.

Understanding the relationship between selection and HRM practices is ultimately an empirical task. In contrast to the theoretical predictions derived from neoclassical theory, it is likely that, as suggested by SHRM research, different HRM practices are complements: for example, using a selection process focused on screening for reciprocal agents and a compensation system offering team-based rewards.

When thinking about possible implications of the complementarity between HRM practices and selection for empirical investigation, one has to take different aspects into consideration. On the one hand, the practices involved have to be determined, which is where experiments come into play. On the other hand, higher-scale empirical approaches like insider econometrics and WMS-type surveys have the important role to identify clusters of practices that are found in similar environments.

3.1.4. Conclusions from the Model

To conclude and sum up the insights from modelling a simple contracting situation with reciprocally motivated agents again, we have seen that the composition of the workforce and the effect of HRM practices are interdependent. In this respect, the design of incentive schemes and the effects from selection and matching cannot be treated separately.

3.1.5. Broader Interpretations of the Model

In the following, we consider some ways in which our framework can be thought of in a more general way, indicating that we are hinting at a more general pattern. There are two aspects we want to stress: first, our results can be compared to arguments from identity economics (Akerlof and Kranton, 2000, 2005). Second, as already noted above, despite the fact that the standard agency model incorporates monetary benefits and we also frame our model in this terms, incentives do not have to be defined as being purely monetary.

Identity. Although we define the non-standard motivation of agents in our model as the agent being reciprocally motivated, many of our arguments are parallel to arguments of the identity literature. In one of their seminal papers on the topic, Akerlof and Kranton (2005) make the general argument that there is a "missing motivation in economists' current depiction of organization" (Akerlof and Kranton, 2005, p.10); hence, the authors explore the role of identity as supplement to monetary compensation, which is also what we do. An important feature of their model is that utility from identity depends on the deviation of identity from norms/ideals, which makes it situation-specific. Their model is similar to ours in the sense that utility from compensation consists of a classical monetary and an additional identity-dependent part, but different in the sense that while η in our model is continuous, the agent in Akerlof and Kranton (2005) can only be either insider or outsider; the identity variable is binary. In addition, while our model focuses on gains from positive reciprocity[14], agents with identity motivation can either gain from adhering to the organization's goals when they are insiders or lose when they are outsiders; the classic case of pure monetary motivation is not directly incorporated. Nevertheless, the authors derive a result that is similar to ours: being an insider leads to a reduced wage differential. Akerlof and Kranton (2005) conclude that "identity flattens the optimal wage schedule, indicating identity and monetary incentives are substitutes" (Akerlof and Kranton, 2005, p.15). However, this is not a general result in their model as the optimal effort can shift upwards with more than two actions, possibly making the optimal wage differential steeper and the two motivations complements rather than substitutes.

When relating their model to the workplace, the authors explicitly define that the dichotomy of insiders and outsiders can be thought of as the dichotomy of extrinsic and intrinsic motivation in management. Modern management approaches – like Management by Objective or investments in corporate culture – aim at aligning the goals of workers with those of the firm, essentially trying to shift workers from being outsiders to being insiders.

In a more general sense, our formulation – based on Englmaier and Leider (2012a) – like the identity formulation of Akerlof and Kranton (2005), the model incorporating trust by Sliwka (2007), or the theoretical formulations incorporating motivated agents (e.g., Besley and Ghatak, 2005; Cassar, 2014b), can all be thought of as the utility representation of workers internalizing the firm's goals. In this respect, the aspect of motivation that is influenced by HRM practices, η_2 in our model, can be reinterpreted as investment into category affiliation, or, exactly like in the identity framework, as investments into goal alignment. The only differences between the models are then the way of thinking about the underlying mechanism and the underlying inherent motivation of the agents. Again, differentiating between the explanations and carving out the under-

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[14]Dohmen et al. (2009) find that positive and negative reciprocity are distinct traits.

lying mechanism is ultimately an empirical task with a clear-cut role for experimental investigation.

Benefits. As already briefly noted at the beginning of Section 3, narrowly interpreted, the model (as well as the standard agency model) describes a situation in which a monetary payment, the wage, is exchanged for effort exertion by the agent. However, interpreting the model in a broader sense is possible. All the formulations are essentially set up in utility terms; hence, one could also think about the bonus as any benefit for the agent generating a utility rent and about effort exertion as everything that is beneficial for the company, which includes, for instance, retention of the employee.

Again, this way of generalizing the model has numerous empirical implications. Naturally, thinking about the problem in this generalized way means that it loses structure, but also again highlights the role of experiments to identify which benefits can substitute for money and which actions of the agent can substitute for effort – and, ultimately, to clarify whether the relationship between different types of incentives and benefits is really that simple.

3.2. Empirical Support for a Role of Social Preferences in HRM Practices

Having now shown that social preferences of agents might matter in organizational settings, we proceed by giving a brief overview over some empirical studies that lend support for the actual significance of social preferences.

First, there are numerous laboratory experiments that can be interpreted in this direction; Fehr and Schmidt (2006) or Camerer and Weber (2013) provide extensive surveys of this line of research. Second, there are also first attempts to investigate this relationship in real-world settings using administrative and firm level data. For instance, Leuven et al. (2005) propose reciprocity as explanation for why firms overinvest in general and specific training compared to standard theory predictions and show empirically that training investments are greater when the workforce is reciprocal. Dohmen et al. (2009) explore the link between reciprocal preferences and behavioral labor market outcomes and show with data from the German Socioeconomic Panel (G-SOEP) that positive reciprocity is related to high wages, high effort, and life success in general, and Huang and Cappelli (2010) demonstrate that screening for "work ethic" is related to the prevalence of less monitoring, more teamwork, less employee turnover, higher wages, and higher firm productivity in US data. While one has to keep in mind that these types of studies are a first step and only provide suggestive evidence for the role of social preferences, they highlight that there is indeed scope for future research. Englmaier et al. (2015b) relate to the model in Englmaier and Leider (2012a) and use personality tests in recruitment as a proxy for a reciprocal workforce and show that this

is linked to wage generosity, provision of non-pecuniary incentives, team work, and higher firm productivity in general using data from the UK Workplace Employment Relations Study (WERS). However, although all of these studies provide excellent starting points for future research, they all build on cross-sectional data and cannot identify causal effects.

More recently, various researchers have begun to take the question of how reciprocity matters in workplace interactions to the laboratory. Cabrales et al. (2010) find that heterogeneous social preferences are a significant predictor of choices for firms and workers in a multi-stage labor market experiment, and Bartling et al. (2012) show that screening for both work attitude and labor market competition are causal determinants of the viability of high-performance work systems in an experimental labor market. Two complementary studies conducted by Englmaier and Leider (2012b,c) explore determinants for the existence of the gift-exchange mechanism both in the laboratory and in the field and show that context matters for the viability of gift exchange.

Determinants of Productivity. One of the aspects that have mostly been neglected in the literature so far is a closer look at the distribution of individual productivity (output in a job), which seems to be driven not only by ability, but also by different facets of personality traits. This is the case in particular in labor market settings where employees work under imperfect incentives in agency relationships. Output we observe there is not necessarily reflecting agents' productivity – as in their innate ability – but much rather the compound reaction to prevailing incentives, determined by ability *and* other personality traits. In other words, the actual performance of employees might be less dependent on innate ability and more dependent on non-monetary preferences and personality traits than admitted in economics research to date. This in turn influences how productivity should best be measured and thought about to avoid confounds.

To first highlight the problem of the productivity-performance divergence, we consider the laboratory experiment conducted by Englmaier et al. (2014), who aim at demonstrating that not only purely ability-driven productivity, but also social preferences of workers matter for the effectiveness of incentive schemes. They investigate if and how firms use information about workers' abilities and trustworthiness when offering contracts in a moral-hazard situation by conducting an experiment consisting of two parts. In the first part that aims at measuring productivity and trustworthiness of individuals, subjects work on a real-effort task for which they receive a piece-rate payment – performance in this task serves as productivity measure –, and make choices in a simple, binary trust game, without knowing details about the second part of the experiment. In the second part, subjects are randomly assigned the role of either firms or workers and interact in a one-shot gift exchange game. Before choosing which contracts to offer, a varying amount of information of productivity and/or trustworthiness

is disclosed to firms. Using this design, Englmaier et al. (2014) are able to show that offered contracts are indeed contingent on information on both dimensions, that higher wages predict higher output, that firm profits vary across worker types with higher and less dispersed profits when employing trustworthy workers, and that this stems from the fact that trustworthy workers "live up to their potential", i.e., that their performance is much closer to their first-stage productivity. Interestingly, while productivity in the first stage of the experiment is normally distributed, performance in the second stage is almost equally distributed, with a masspoint of cases at the lower end. See Figure 5 for histograms of the relative prevalence of correctly solved items in the two experimental stages. In this setting, it is evident that much of the actual outcome for firms is not driven by ability of workers, but rather by their social preferences. Hence, trying to back out ability (innate productivity) from workers' job performance would lead to severe mis-measurement.

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Another study hinting at additional drivers of productivity focuses on personality traits rather than social preferences. Segal (2012) uses data from the unincentivized coding speed test administered as a part of the National Longitudinal Survey of Youth (NLSY) to show that performance in simple, low-stakes tests can be linked to future economic success via personality traits of test takers that reflect their inherent level of "intrinsic motivation". More specifically, she shows that future earnings of male NLSY participants are correlated to coding speed scores, even when controlling for cognitive ability, and links these scores to the intrinsic motivation of test takers via indirect field evidence from the US military; in this way, the author shows that highly motivated, but less educated men, which are potential military recruits, achieve higher scores. In addition, Segal (2012) conducts incentivized experiments in which participants have to work both on an incentivized and on an unincentivized task and shows that subjects differ substantially in their relative performance across these tasks. These differences in the "intrinsic motivation" of individuals can be linked to test takers' personality traits, in particular conscentiousness. Thus, Segal (2012) provides additional evidence that ability is not the single important factor influencing productivity, but that also other aspects have to be considered.

Empirical Evidence for the Importance of Referrals.   In addition to these performance-related issues, our model outlined above as well as the research hinting at its empirical validity demonstrate that the matching of "types" of firms and workers is crucial. To achieve this, firms can utilize various methods – they can screen workers by offering menus of contracts and let them self-select into occupations, or carefully test and screen applicants. Another method would be to just ask current employees to suggest fitting

applicants, or, in other words, request referrals. Recently, this mechanism has been receiving increased attention. By giving a brief overview about some of the studies in this area, we aim at investigating how evidence on referral hiring fits into the framework sketched out above.

One recent study providing field evidence is Beaman and Magruder (2012), who conduct an experiment in urban India to explore whether referrals can serve as screening mechanism to reduce asymmetric information. They ask for referrals and vary the financial incentives for doing so. In this way, they show that the most valuable referrals come from high-skilled individuals, but that these are more useful if a performance-based incentive scheme for referring is offered. In addition, by analysing performance of the referrals, they show that this result cannot be fully explained by observable characteristics, pointing to the added value of referrals. More generally, Pallais and Sands (2013) focus on the effects of using referrals as recruiting device on job performance by conducting three field experiments in an online labor market exploring performance differences between referred and non-referred workers. They find that the differences in performance and employee turnover can be explained by selection and team production. Burks et al. (2014) use personnel data to explore the benefits of referral hiring for firms. While they find no difference in productivity, employee turnover of referred workers tends to be lower, leading to higher profits per worker when lower hiring costs are also taken into account. This seems to hold especially for high-productivity referrers and in strong labor markets.

Summing up, these studies emphasize that matching seems to matter and in turn may be a reason for the use of referrals. However, the aforementioned studies focus solely on referrals and therefore are silent about other HRM practices that firms employ. In contrast to that, our model predictions rely on the interactions between practices, and complementarities seem to be important for productivity outcomes. Consequentially, more research that explicitly refers to the complementarities between HRM practices and the role of referral hiring is needed.

4. Empirical Agenda

One point we explicitly want to stress in this section before concluding our review is the need for comprehensive, multi-level field data that account for the complex multidimensionality of the effect that HRM practices have on performance outcomes of firms. Or in simple terms: in order to identify complementarities in the data, it is important to capture all relevant dimensions. More specifically, our conviction is that longitudinal, detailed data are needed. In the following, we give a short overview of the Organizational Observatory (O^2), an interdisciplinary research initiative at the University of Munich to collect data that is suitable to answer some of the questions raised above.

4.1. Organizational Observatory (O^2)

The Organizational Observatory (O^2)[15] aims at collecting rich primary data on organizations, their structure and design, with an emphasis on management practices that have not been studied extensively in the WMS, while striving for comparable data quality. In order to be able to capture the above suggested broad possibilities for complementary HRM practices, the scope of the O^2 is broader than the scope of the WMS. As the WMS, the survey is conducted in the form of a semi-structured telephone interview that lasts 45 minutes on average.

The survey population consists of all firms with at least one manufacturing establishment according to Amadeus, a Bureau van Dyck database covering most German firms. Within these firms, production managers of largely representative production sites are interviewed by specifically trained interviewers. The questions are a mix of Likert-type questions and WMS-type open questions that are scored by the interviewer, which aims at managing the trade-off between depth of information and number of items. As validity of the survey largely relies on interviewers' competence in conducting the interviews and scoring responses, interviewers are carefully recruited and intensively trained.[16]

As already hinted above, O^2's main aim is to provide a solid foundation for capturing the more complex, complementary structures of HRM practice clusters. Here, one focus is on recruiting practices, in particular the use of referrals, and the interrelation with other HRM practices. Once future waves are collected, the data will enable us to analyze complementary relationships between referrals and other practices and allow us to predict critical determinants for a productive use of referral hiring.[17]

Having this long-term goal in mind, we want to briefly sketch out plans for O^2. To be able to answer more detailed and higher-order questions, we will naturally improve O^2: First of all, the sample will be broadened to both increase power and to allow for more general conclusions. In addition, building a panel structure is essential for addressing higher-order questions and make progress towards establishing causal relationships. Moreover, the survey methodology will be continuously developed based on structured evaluations of the first wave(s) to reflect up-to-date research on the HRM practices

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[15]http://www.organizations-research-group.uni-muenchen.de/projects/organizational_observatory/index.html

[16]Under the auspices of the Organizational Research Group (ORG; http://www.organizations-research-group.uni-muenchen.de/), a joint research initiative by economics and management scholars at the University of Munich, this survey method has been implemented twice -– on a sample of manufacturing firms in summer 2013, and on a sample of small and medium sized, fast-growing firms in summer 2014. Further waves are planned for late 2015 and the subsequent summers.

[17]For the interested reader, a brief overview over variables included in the first O^2 wave as well as some preliminary analyses of relationships of referrals with other HRM practices and performance outcomes are provided in Appendix B. Interestingly, our analysis yields a negative relationship between the use of referrals and firm performance which seems to be at odds with some of the results presented earlier and hints at a more complex relationship between HRM practices.

measured and to take their possible complementarities into consideration. Finally, to get at the core of the problem, multilevel data are needed, which requires to also survey employees. Related to this, we want to stress that there are some other groups of researchers that try to investigate these kinds of questions by producing high-quality, detailed data; one example for this is the Linked Personnel Panel (LPP) that combines firm- and employee-level data; see Kampkötter and Sliwka (2015).

5. Conclusion

By investigating the role of HRM practices for explaining persistent productivity differences and exploring the concept of complementarities between them, we have shown that integrating different research strands and employing different methods helps to gain new insights and to understand a field more thoroughly. Especially for the role of complementarities of HRM practices, we have demonstrated how linking seemingly unrelated results from behavioral economics research on social preferences can be fruitful for further research in this area. However, by giving an overview over different issues and upcoming topics like determinants of productivity and referral hiring, we have also highlighted that more research, and especially more comprehensive firm data, are needed.

Briefly sketching the virtuous feedback cycle we envision to evolve between differing research methodologies, consider the following example: cross-sectional studies like the WMS, the LPP, or O^2 provide the possibility to relate within-firm patterns to market-level characteristics like market structure or the intensity of competition. So far, models on behavioral aspects have been largely silent on this topic that is likely to be important, which is why we hope that empirical findings from these surveys will stipulate theoretical research. Again, this will generate new predictions that have to be tested empirically. Here, experimental studies have the role to causally establish hypothesized mechanisms, while insider econometrics studies and new modules in surveys can again help to identify practices and complementarities among them.

Possible topics for further research incorporating complementarities of HRM practices will involve further areas of behavioral economics research. Besides social preferences, which have probably been studied most extensively, there are also various other concepts yielding insights that are likely to matter in this setting. First, there is an upcoming branch of research on time inconsistent preferences of agents that lead to self-control problems and procrastination (O'Donoghue and Rabin, 1999a,b). Here, one major insight is that sophisticates, i.e., those agents who know about their time inconsistency and seek to avoid it, might actively search for commitment devices, and firms that know about the problem of time inconsistency, might in turn desire to employ sophisticates. As a consequence, offering commitment devices might be one strategy

for achieving this. For instance, up or out schemes, conditional training or rotation schemes, or gym memberships, can be interpreted in this way (see Englmaier et al., 2015a, for an attempt to capture this idea theoretically within a long-term employment contracting framework). In addition, non-standard beliefs like overoptimism and overconfidence might also matter when thinking about interrelations between HRM practices (see, e.g., Larkin and Leider, 2012; Sautmann, 2013). However, note that in this areas, as well as in other subfields of behavioral economics research, insights almost exclusively stem from experiments conducted in laboratory settings, with few firm data available. Here, perhaps even more than in the area of social preferences, it is crucial to push for comprehensive multi-level field data.

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A. Additive Formulation of Worker Type and HRM Practices

Consider a simple, linear relationship between inherent and influenceable reciprocity: $\eta = \eta_1 + \eta_2$. Then, one can simply exchange η in Proposition 3.3 and again derive the comparative statics of the optimal bonus payment to see how an increase in η_2, for instance by investment in team building, influences b:

$$\frac{\partial b}{\partial \eta_2} = -\frac{\Delta\pi\Delta ER}{\left(\Delta\pi + (\eta_1 + \eta_2)\,\Delta ER\pi_H\right)^2}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right) < 0.$$

The second derivative as well as the cross-derivative are globally positive, indicating diminishing marginal returns of an increase in η:

$$\frac{\partial^2 b}{\partial \eta_2^2} = \frac{\partial^2 b}{\partial \eta_1 \eta_2} = \frac{\Delta\pi\left(\Delta ER\right)^2\pi_H}{\left(\Delta\pi + (\eta_1 + \eta_2)\,\Delta ER\pi_H\right)^3}\left(\underline{w} + \frac{\pi_L}{\Delta\pi}c\right) > 0.$$

In this case, the two components of the reciprocity term act as substitutes, i.e., the firm can lower the bonus either by hiring workers with an inherent concern for reciprocity in the first place, or by triggering reciprocal concerns later on through investments in HRM practices. This relationship can also be seen in the plot of the optimal bonus dependent on η_1 and η_2 in Figure 4.

-- Include Figure 4 about here. --

B. First Analyses of O^2 Data

First Tentative Results   As the O^2 initiative is still at the very beginning and only the first waves have been conducted, one has to wait before being able to exploit a broadened sample and the panel structure of the data to identify effects. However, we still want to provide a first glimpse at the richness of the data and possible questions that could be answered by using it. For doing so, we focus on the role of referrals, which is one of the upcoming topics of research, as indicated in Section 3.2.

First, we give an overview of the relevant measures available in the data. In the main interview that was conducted with production managers, two questions assessing the relative importance of referrals in the hiring process of production workers are asked – one focuses on the relative importance for stocking the applicant pool, while the other assesses how relevant referrals are throughout the selection process. Several other questions measure various other HRM practices – there are three WMS-type open questions on the sophistication of the screening process, information sharing, and co-ordination, respectively, as well as average Likert scores on four dimensions (decision processes, corporate culture, communication, and coordination). In addition, the survey includes data on the prevalence of variable pay, both on the fraction of employees receiving variable pay and on which percentage of overall pay is variable on average. Various firm-level outcomes like sales, ROCE, and employee turnover rates are available as proxies for productivity. In addition, an interview with the HR manager of a subsample of firms was conducted, which consists of several more specific questions on the referral process.

Given these measures, we first explore raw bivariate correlations among the different HRM practice measures. All in all, there seem to be few correlative relationships between the management measures. The two referral indicators are positively correlated ($r = .27$, $p < .01$); however, both referral measures are not correlated with any other management measures, with the exception of communication and the sophistication of the selection process. For the other HRM practice measures, there are unsystematic correlations only, mostly between those practices that were measured using WMS-type questions. The same picture emerges when we try to predict the use of referrals using the other HRM practice measures – the two referral measures predict each other, but otherwise, no clear pattern emerges. Using the more detailed measures from the HR interview yields a similar picture.

To further investigate how referrals are related to productivity measures in interplay with the other measured HRM practices, we present simple regression analyses with varying specifications. For log-normalized sales as a measure of performance, when only importance of referrals in recruiting is considered, it turns out to be a significant, but small and negative (!) predictor; when the other management measures are added, significance vanishes. Adding interaction terms for referrals and corporate culture and the use of variable pay to account for possible multiplicative relationships does not change the results (see Table 1, columns (1) and (3)). Of the more detailed referral measures from the HR interview, again only the importance of referrals in recruiting turns out to be significant and negative (see Table 1, column (4)). Using ROCE as alternative performance outcome does not change the results (see Table 1, column (5)). For employee turnover rates as additional alternative outcome measure (not reported here), no clear pattern emerges, and R^2 values are very small.

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                    -- Include Table 1 about here.   --
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Interpretation   When interpreting the results of the investigation above, note that these are based on cross-sectional, observational data, which do not allow to infer on causal relationships and, additionally, that simple correlation and regression analyses cannot capture the whole complicated, complementary structure of interactions between HRM practices suggested in Section 3. However, the data still provide some interesting insights that can give rise to new questions that have to be answered by future research.

First of all, other than the studies sketched in Section 3.2, which all more or less indicate that referral hiring has positive implications for performance and employee turnover, our data suggest that, if there is any relationship between the use of referrals and performance at all, it is a negative one. This fundamental puzzle deserves some further thought.

One could hypothesize about possible mechanisms behind this. For instance, referrals could be of more use for smaller firms than they are for larger organizations, or, derived from the fact that reliance on referrals correlates negatively with "sophistication" of the screening mechanism used, referrals tend to be used as replacement for other aspects of recruiting, which does not seem to be a good strategy performance-wise.

C. Figures and Tables
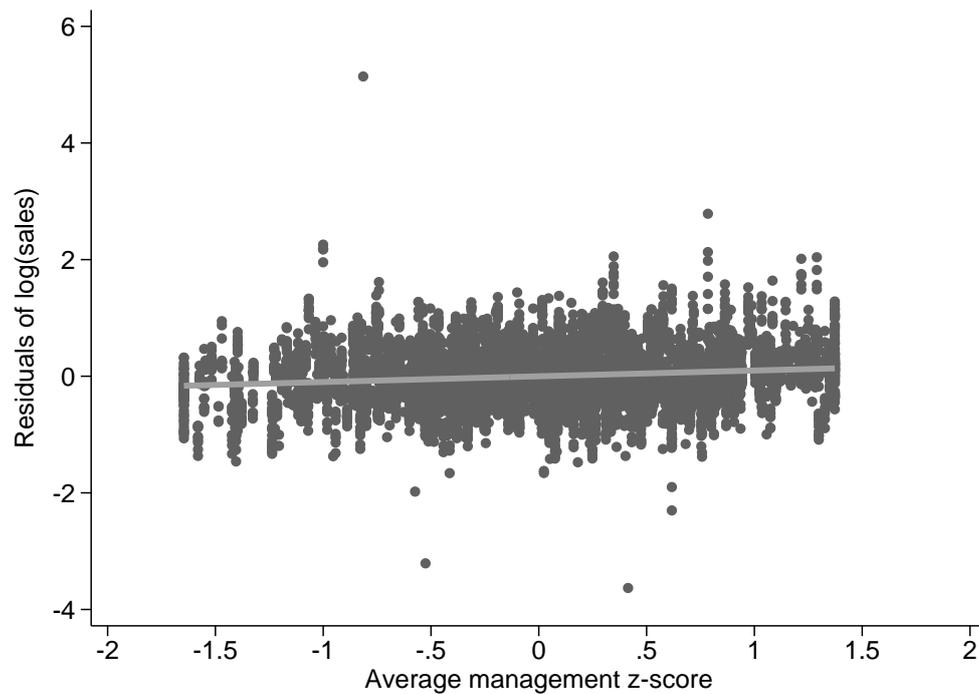
Notes: The figure plots the residuals of a regression of the log number of sales on the log number of employees, a key performance measure used by Bloom and Van Reenen (2007), and the average z-standardized management scores of the surveyed firms. Data are generously provided at: `www.http://worldmanagementsurvey.org/`. The figure is based on own calculations.

Figure 1: Residual plot of log(sales) on average management scores
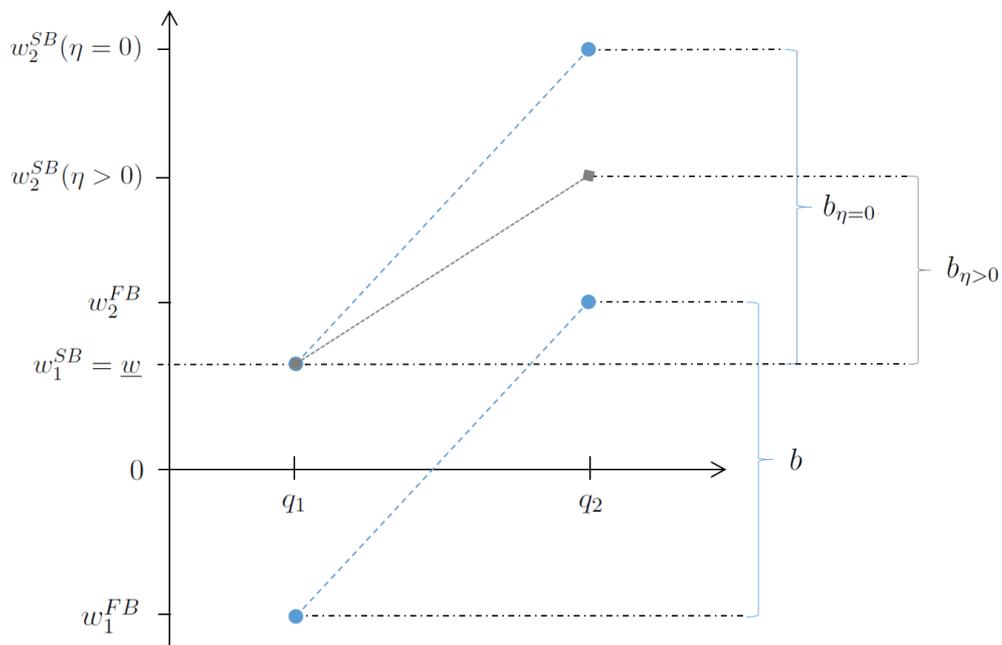
Notes: The figure depicts the exemplary first best contract (lower dashed line), the second best contract for a selfish agent (parallel dashed line above the first best line) and the second best contract for a reciprocal agent (dotted line).

Figure 2: Illustration of the wage schemes
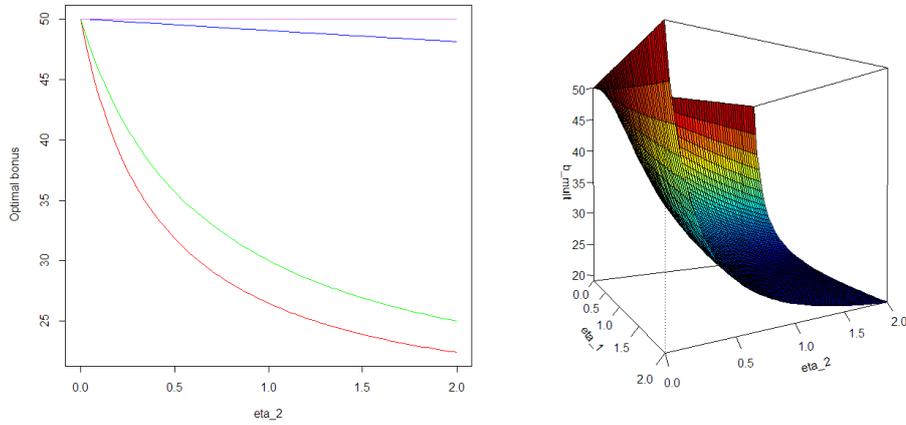
Notes: The figure depicts the optimal bonus as function of, the parameters capturing the innate reciprocal inclination of a worker and the HRM policies targeted at increasing this reciprocal inclination towards the firm, for a multiplicative formulation $\eta = \eta_1 \times \eta_2$.

Figure 3: Optimal bonus dependent on η in multiplicative model
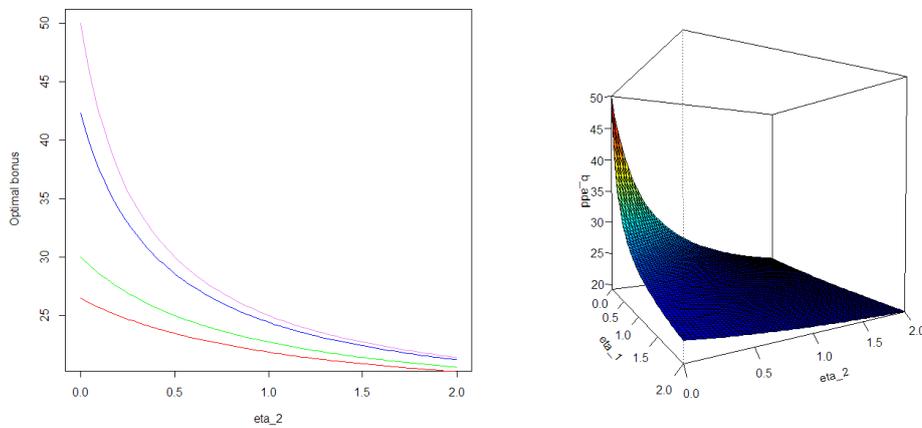
Notes: The figure depicts the optimal bonus as function of, the parameters capturing the innate reciprocal inclination of a worker and the HRM policies targeted at increasing this reciprocal inclination towards the firm, for an additive formulation $\eta = \eta_1 + \eta_2$.

Figure 4: Optimal bonus dependent on η in additive model
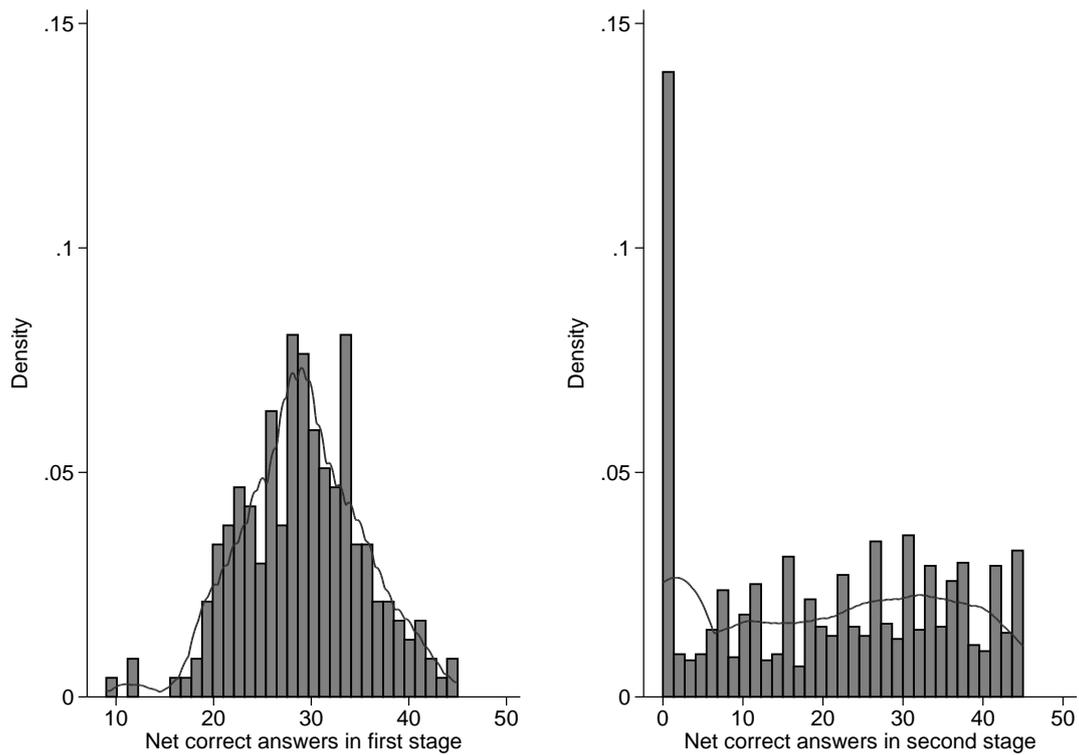
Notes: The left panel depicts the distribution of innate ability (for a specific task) measured in an incentivized setting with piece rate incentives. The right panel depicts measured performance in this very same task in a employment setting with incomplete contracting, i.e., absent piece rate incentives. The figure is based on actual data from Englmaier et al. (2014) but shows novel analysis.

Figure 5: Histogram of productivity and performance in Englmaier et al. (2014)

	(1) log(sales)	(2) log(sales)	(3) log(sales)	(4) log(sales)	(5) ROCE
Referrals (Recruiting)	-0.0976** (0.0393)		0.252 (0.391)		
Referrals (Screening)		-0.00662 (0.0753)	0.667 (0.709)		
Referrals (Recruiting) HR				-2.450* (1.014)	-101.4** (49.83)
Referrals (Screening) HR				-0.515 (0.825)	5.756 (30.99)
Referrals (Sum)				-0.109 (0.0739)	2.864 (2.413)
Screening Quality (WMS)			0.0226 (0.0441)	0.0491 (0.0453)	-0.649 (1.963)
Information Sharing (WMS)			0.0743 (0.0488)	0.0910 (0.0597)	2.847 (1.828)
Coordination (WMS)			-0.0700 (0.0421)	-0.154 (0.122)	-3.153 (2.320)
Decision Processes (Sum)			-0.182 (0.154)	-0.126 (0.0901)	-14.09** (6.179)
Communication (Sum)			0.0504 (0.0396)	0.104 (0.231)	9.939 (6.014)
Corporate Culture (Sum)			0.377 (0.282)	-0.0256 (0.0997)	-9.900* (5.397)
Coordination (Sum)			-0.110** (0.0447)	-0.130* (0.0565)	-0.319 (3.473)
% employees with variable pay			-0.000875 (0.00157)	-0.00466 (0.00335)	-0.130** (0.0616)
Variable income (managers)			0.00756** (0.00248)	0.0111 (0.0127)	-0.351* (0.201)
Variable income			-0.00407 (0.00493)	-0.00362 (0.00666)	0.151 (0.215)
Observations	464	464	305	69	71
R^2	0.608	0.606	0.605	0.875	0.522
Interactions			X	X	X

Notes: In all models, firm size (measured as the number of employees) and interviewer dummies are added as controls. In addition, in models (3) to (5), interaction terms of the referral measures with incentive pay and screening quality are added. Robust standard errors (clustered at interviewer level) are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 1: Regression of log(sales) on referrals and controls